CONCRETE REINFORCEMENT

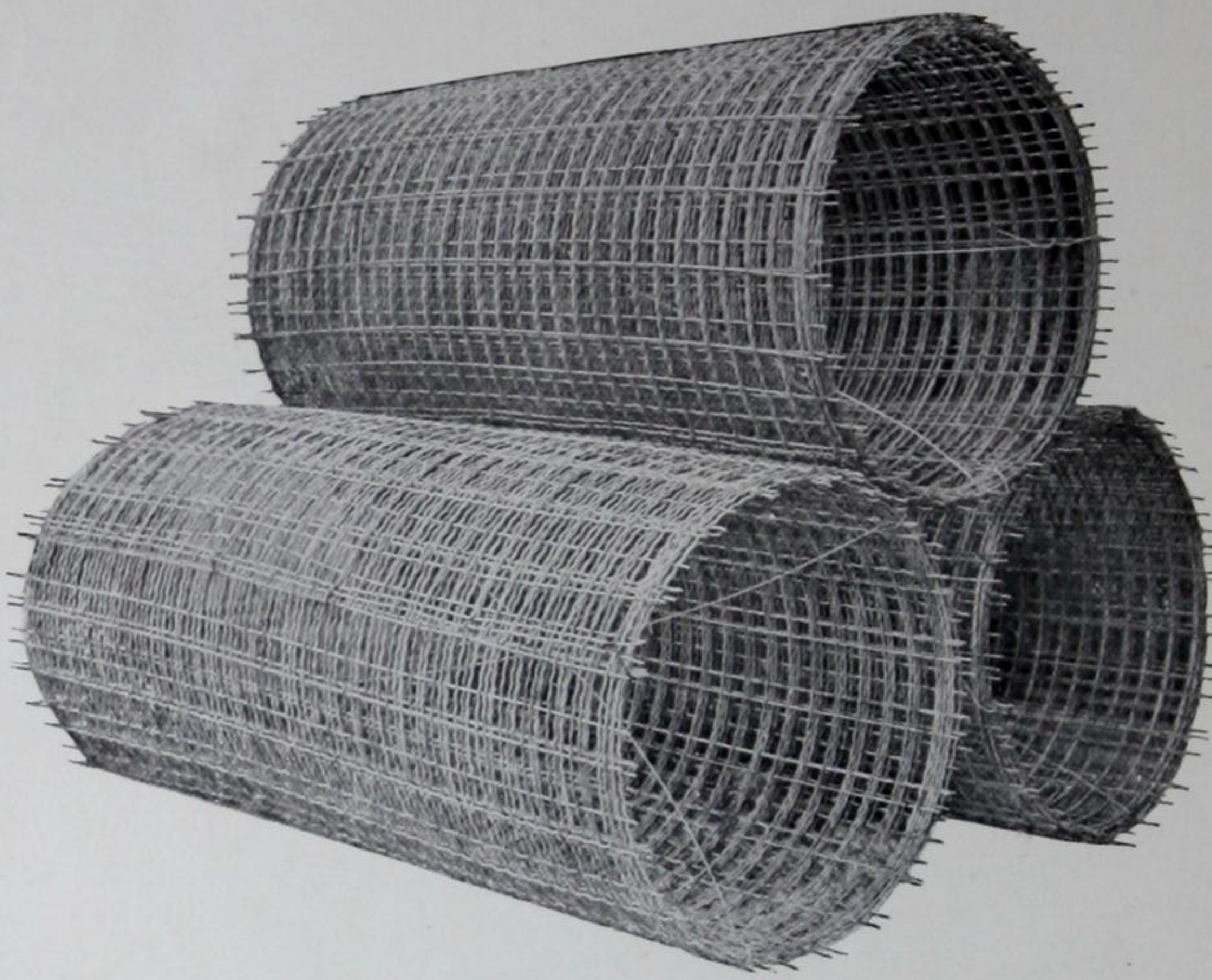
MANUFACTURED BY

TRADE MARK

Canada Wire & Iron Goods Company

Hamilton, Ontario

Quality of Steel for Reinforcing



The material from which our wire mesh reinforcement is made is the product of the wire drawing mill, and can be safely worked to 20,000 pounds per square inch of section as against 16,000 pounds per square inch of section for rolled bars, which in itself produces economy by its use.

While there may or may not be advantages in using a high carbon, high tensile strength steel in reinforcing concrete, the opinion in general seems to be in favor of a medium or mild steel.

Our Engineers recommend the use of a fabric made with mild steel, but we can furnish it in any grade of steel desired.

While reinforcing fabrics are made both galvanized and not galvanized, we strongly recommend the latter, due to the fact that a much better adhesive bond is provided and also greater strengths. In the case of a galvanized wire, the adhesion between the reinforcement and the concrete is to the coating on the steel and not to the steel itself, and also in the galvanizing process the steel is annealed or softened, thereby reducing its elastic limit and ultimate strength.

It is a well-known fact that steel thoroughly inbedded in a proper mixture of concrete does not rust, and in the case of a smooth round rod used as reinforcement it is more desirable to have a thin surface coat of rust than if it were perfectly bright and smooth, provided the rust has not penetrated sufficiently far to pit the steel and produce a scale. This slight coating of rust provides a rougher surface and therefore a better bond.

INTRODUCTION

In presenting this edition of our catalogue relating to our Cold Drawn Crimped Steel Wire Reinforcement for Concrete we have endeavored to cover concisely, not only the application of the reinforcement for concrete, but concrete itself.

The Tables contained herein have been carefully assembled by our Engineering Department and will be found safe and conservative.

By following the directions herein given as governing the use of Tables and Curves suitable fabric may be selected to use with or without bars for all kinds of loads and spans and conditions met with in the construction of Buildings, Bridges, and Reinforced Concrete in general.

Our Crimped Steel Wire Fabric, we believe, is the most efficient reinforcement on the market and in substantiation of this we would point out the following features:

Continuous Bond from one end of the Structure to the other.

Minimum Cost of laying down.

Stress Wires or Carrying Members evenly spaced and in direct tension.

Eliminates all trouble with any members being out of position after installing.

Easily handled.

With two methods of reinforcing that are mechanically equal in strength that one is the better which can be handled and placed, and kept in place with the least expenditure of labor. This property is readily found in the wire mesh system, manufactured by us, and which has in recent times come into prominence for slab construction when designed for use with beams and girders.

Properties of Concrete

A knowledge of the properties of materials is essential for safe and economic designing of structures. The properties of reinforced concrete comprise not only those of the concrete and of the steel elements considered separately, but may be said to include those properties or characteristics of the composite mass that control the distribution of stresses between the elements of the combination of units and determine the nature of their inter-relation. Such properties as are required by the practical engineer or architect in intelligent designing are here assembled in concise form, with values assigned to them that are considered to be safe and conservative deductions.

Concrete may be defined as an artificial stone produced by the hardening or setting of a mechanical mixture of an hydraulic cement with sand, broken stone or gravel and water.

The proportions of the different ingredients are usually measured in relative volumes with the quantity of cement as unity, although they may be—and quite properly—measured by relative parts by weight.

The proper portioning of concrete is an important matter.

A properly proportioned concrete should have a quantity of cement which will a little more than fill the voids or interstices in the sand and sufficient of the mortar thus formed should be used to fill the voids or interstices in the broken stone or gravel as the case may be.

Many engineers require that the sand should be half the volume of the stone, and the cement half the volume of the sand, thus giving mixtures of the type

1: 1½: 3
1: 2 : 4
1: 2½: 5
1: 3 : 6

while others again call for mixtures in which the volume of the stone is equal to twice the volume of sand plus the cement, thereby allowing for the increased volume of the mortar over the original volume of the sand from which it is made. Such mixtures would be designated by

1: 1½: 4
1: 2 : 5
1: 2½: 6 etc.

Both systems are based on 50 per cent. of voids in the stone or gravel.

The voids in broken stone screened to a uniform size are greater than in crusher run, and the same applies to gravel of uniform size and run of the bank after the sand has been removed.

The voids in crushed stone screened may run as high as 50 per cent., while with a properly graded mix of various sizes the voids may be reduced to 30 per cent., and even lower. It is customary to allow in the absence of further information a void allowance of 40 per cent. or 45 per cent. of the volume of the loose material.

The per cent. voids in sand varies with different sands, and is less in sands with a variety of sizes of grains than in sands where the grains are all of the same size and general shape. Further, a sharp sand is a sand with angular grains, and will have a larger percentage of voids than the sand whose grains are rounded.

While the theory of reinforced concrete cannot be dealt with in these pages it should be borne in mind that there is a certain depth of slab and a certain amount of steel required in a beam or slab in order to produce unit stresses in the concrete and steel up to their working values. If a slab is made too thin, no doubt sufficient steel may be added to take care of the tension, but the concrete may fail by excessive stresses, so a slab could be made so deep that the concrete would stand the stresses and the steel fail, so that it is seen that a proper relation must exist between—depth of slab—and area of steel.

By the depth of slab is meant the distance from the compressed surface of the concrete to the centre of the steel,, and the thickness is obtained by adding the thickness of concrete below the steel, which is usually from ¾″ to 1″.

Generally speaking, slabs are of two kinds (i. e.) freely supported or continuous. In the former the edges of the slab are merely supported, while in the latter they are more or less fixed by the loading of the adjacent panels, the amount of fixing being dependent upon the amount of the loading.

In a freely supported slab, the bending moment at the centre is given by the formulas $M=\frac{Wl^2}{8} \times 12$

where M=BM in inch pounds.
W=load per square foot.
L=span in feet.

In a continuous slab the BM at the centre is $M=\frac{Wl^2}{24} \times 12$, but at the supports the bending moment is $M=\frac{Wl^2}{12} \times 12$ and is of a negative nature or, in other words, when the centre of a span sags down causing the bottom fibres of the slab to stretch, the portion over the support "hogs" and causes the upper fibres to stretch. **In this connection it is very important to note that in continuous slab construction the reinforcement over the supports should be as near the upper surface of the concrete as it is near the lower surface at the centre, and that it should be near the top of the slab out to a distance of one-quarter the span on each side of the support. If this is not done the slab will invariably crack over the support, and this cracking may prove dangerous if the shear stress is of any great amount.** See Fig. on page 21.

The value of M usually taken for continuous slab work is $M=\frac{Wl^2}{10} \times 12$.

Where M is in inch pounds. Bending moments for $M=\frac{Wl^2}{8} \times 12$, $M=\frac{Wl^2}{10} \times 12$ and $M=\frac{Wl^2}{12} \times 12$ are given in the following tables for spans from 2′ 0″ to 8′ 0″ and total loads from 50 pounds to 350 pounds per square foot.

By total load is meant the live load per square foot plus the weight of the slab per square foot.

TABLE NO. 1

BENDING MOMENTS INCH POUNDS

Based on $\frac{Wl^2}{8} \times 12$

TOTAL LOAD PER SQUARE FOOT

SPAN	50 pounds	75 pounds	100 pounds	125 pounds	150 pounds	175 pounds	200 pounds	250 pounds	300 pounds	350 pounds
2'·0"	300	450	600	750	900	1050	1200	1500	1800	2100
2'·6"	469	725	938	1120	1405	1640	1875	2345	2810	3280
3'·0"	675	1013	1350	1690	2028	2365	2700	3380	4060	4730
3'·6"	918	1378	1838	2300	2755	3215	3675	4600	5520	6430
4'·0"	1200	1800	2400	3000	3600	4200	4800	6000	7200	8400
4'·6"	1520	2280	3038	3800	4560	5320	6075	7600	9125	10650
5'·0"	1875	2810	3750	4685	5625	6560	7500	9370	11250	13130
5'·6"	2265	3400	4537	5670	6800	7940	9075	11330	13600	15850
6'·0"	2700	4050	5400	6750	8100	9450	10800	13500	16200	18900
6'·6"	3160	4750	6338	7920	9500	11080	12650	15820	19000	22150
7'·0"	3675	5510	7350	9190	11020	12850	14700	18375	22050	25700
7'·6"	4125	6325	8438	10540	12650	14760	16880	21080	25300	29500
8'·0"	4800	7200	9600	12000	14400	16800	19200	24000	28800	33600

NOTE.—This table of B. M.'s takes care of slabs which are not continuous, such as a corridor floor supported by a "chase" in a fire or party wall.

TABLE NO. 2

BENDING MOMENTS INCH POUNDS

Based on $\frac{Wl^2}{10} \times 12$

For general practice we recommend the use of this formula.

SPAN	TOTAL LOAD PER SQUARE FOOT									
	50 pounds	75 pounds	100 pounds	125 pounds	150 pounds	175 pounds	200 pounds	250 pounds	300 pounds	350 pounds
2'-0"	240	360	480	600	720	840	960	1200	1440	1680
2'-6"	375	563	750	938	1126	1312	1500	1875	2252	2625
3'-0"	540	810	1080	1350	1620	1890	2160	2700	3240	3780
3'-6"	735	1102	1470	1838	2205	2575	2940	3675	4410	5150
4'-0"	960	1440	1920	2400	2880	3360	3840	4800	5760	6720
4'-6"	1215	1823	2430	3040	3646	4255	4860	6080	7290	8510
5'-0"	1500	2250	3000	3750	4500	5250	6000	7500	9000	10500
5'-6"	1815	2723	3630	4540	5445	6355	7260	9080	10890	12700
6'-0"	2160	3249	4320	5400	6480	7560	8640	10800	12960	15125
6'-6"	2535	3805	5070	6340	7610	8875	10140	12680	15220	17750
7'-0"	2940	4410	5880	7350	7825	10300	11760	14700	17650	20600
7'-6"	3375	5065	6750	8438	10130	11810	13500	16875	20250	23620
8'-0"	3840	5760	7680	9600	11520	13430	15360	19200	23040	26860

TABLE NO. 3

BENDING MOMENTS INCH POLNDS

Based on $\frac{Wl^2}{12} \times 12$

TOTAL LOAD PER SQUARE FOOT

SPAN	50 pounds	75 pounds	100 pounds	125 pounds	150 pounds	175 pounds	200 pounds	250 pounds	300 pounds	350 pounds
2 .0"	200	300	400	500	600	700	800	1000	1200	1400
2 6"	313	469	625	782	938	1095	1250	1565	1875	2190
3 .0"	450	630	900	1125	1350	1575	1800	2250	2700	3150
3 6"	613	919	1225	1530	1840	2145	2450	3060	3680	4290
4 0"	800	1200	1600	2000	2400	2800	3200	4000	4800	5600
4 6"	1013	1519	2025	2530	3040	3545	4050	5060	6080	7090
5 .0"	1250	1875	2500	3125	3750	4375	5000	6250	7500	8750
5 .6"	1513	2270	3025	3783	4540	5295	6050	7566	9075	10590
6 .0"	1800	2700	3600	4500	5400	6300	7200	9000	10800	12600
6 .6"	2110	3165	4225	5275	6330	7400	8450	10550	12675	14775
7 0"	2450	3675	4900	6125	7350	8575	9800	12500	14700	17150
7 .6"	2813	4220	5625	7035	8445	9750	11250	14070	16875	19700
8 .0"	3200	4800	6400	8000	9600	11200	12800	16000	19200	22400

NOTE.—This table of B. M.'s can be used when the loads are carefully and uniformly distributed with equal regard as to concrete construction.

The Weights per Sq. Foot of the Different Thicknesses of Slabs for Stone and Cinder Concrete are as follows:

Thicknesses.	2	2½	3	3½	4	4½	5	5½	6	7	8
Stone Concrete	26	32	38	45	51	58	64	70	77		
Cinder Concrete........	19	24	29	34	39	43	48	53	58	68	77

Stone concrete weighs about 150 lbs. per 1 cu. ft.

Cinder concrete weighs about 115 lbs. per cu. ft.

For general slab work a concrete made, 1: 2: 4 or 1: 2½: 5 will give good results, but it is important that the sand and stone should be clean and free from coating of clayey or vegetable matter, as these will prevent the adhesion of the cement.

Concrete should be mixed of a consistency sufficiently wet or mushy as to allow the mortar to flow in around the reinforcing steel and the forms should be sufficiently tight to prevent the flowing away of the cement mortar.

Stone concrete four weeks old should safely withstand a compressive stress of 650 pounds per square inch, while cinder concrete should bear 225 pounds per square inch.

Equal in importance to a concrete of good quality for reinforced concrete is the method and quality of re-inforcing.

As floor loads are usually stated as so much per square foot it is customary to consider a strip of the slab 1′ 0″ wide so that the strip becomes a beam uniformly loaded with the same foot loading as the slab has square foot loading. Incidentally this shows the quantity of steel required per foot width of slab, which in turn enables one to select the proper reinforcing as the wires are generally spaced at some definite fraction of a foot.

The intensity of loading is governed in different places by local building laws, but the following are quoted from the City of Boston Building Laws and recommended by the Boston Society of Civil Engineers:

Dwellings, apartment floors, Apts. in public hotels, 50 lbs. per 1 sq ft.

Public offices of hotels and apartments, 100 lbs. per 1 sq. ft.

Retail stores (public bldgs. except schools), 125 lbs. per sq. ft.

Schools, 80 lbs. per 1 sq. ft.

Schools, in corridors, 125 lbs. per 1 sq. ft.

Assembly halls, 125 lbs. per 1 sq. ft.

Drill room, dance halls, riding schools, 200 lbs. per 1 sq. ft.

Warehouses, merchantile buildings, 250 lbs. per 1 sq. ft.

Kent for factories, 200 to 400 lbs. per 1 sq. ft.

Highway bridges, 80 lbs. per 1 sq. ft.

The Curves given on the following pages will enable one to select the proper Slab Depth, and Steel Reinforcement for all Spans and Loading and Bending Moments given in previous tables:

The method of using them is as follows:

Required to design a floor slab of stone concrete, with a total loading per square foot (i e.) live load and wt. of slab, of 300 pounds, with supports on 6′ 6″ centres.

1st. Referring to BM table No. 2, based on $X = \frac{Wl2}{10} \times 12$ we find that the BM for 6′ 6 span and 300 pounds per square foot is 15220 inch pounds.

Now on the diagram marked stone concrete, run up the left hand scale to 15520 and from there go horizontally till the curve A is reached, call this point X. Now read vertically down below X on the base scale and get the value 3.7″. This is the depth of the slab, call it 3¾″. Now add ¾ inch for concrete below steel, getting a slab thickness of 3¾ plus ¾=4½″.

Now from X go vertically upwards till the curve B is reached and call this point Y. Now from Y go horizontally to the right hand scale and read the scale at .2360 square inches; this is the area of steel required for a 1 foot width strip of slab.

To find out what mesh or weave of reinforcement is required, continue this horizontal line through the series of curves to the right. These latter curves show the area of steel for different sizes of wires on different manufactured pitches at the point where such curves cross the vertical lines from the pitch measurement at the bottom of the right hand diagram.

Any curve representing a wire size which crosses a vertical pitch line at the horizontal line through Y will have just the correct area of steel, and any steel whose curve crosses above the line through Y will have more than enough area.

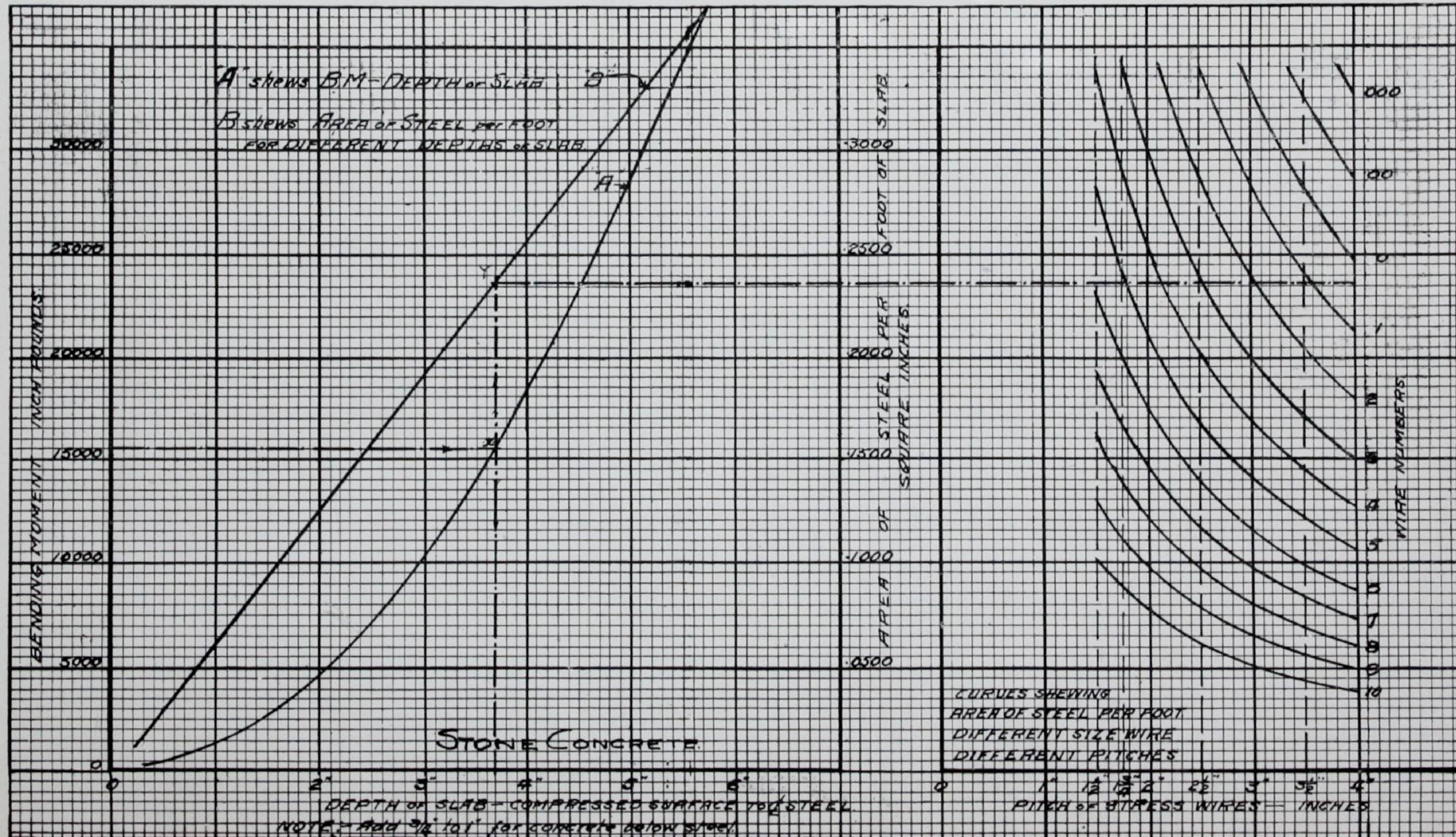
In the case in point we see:

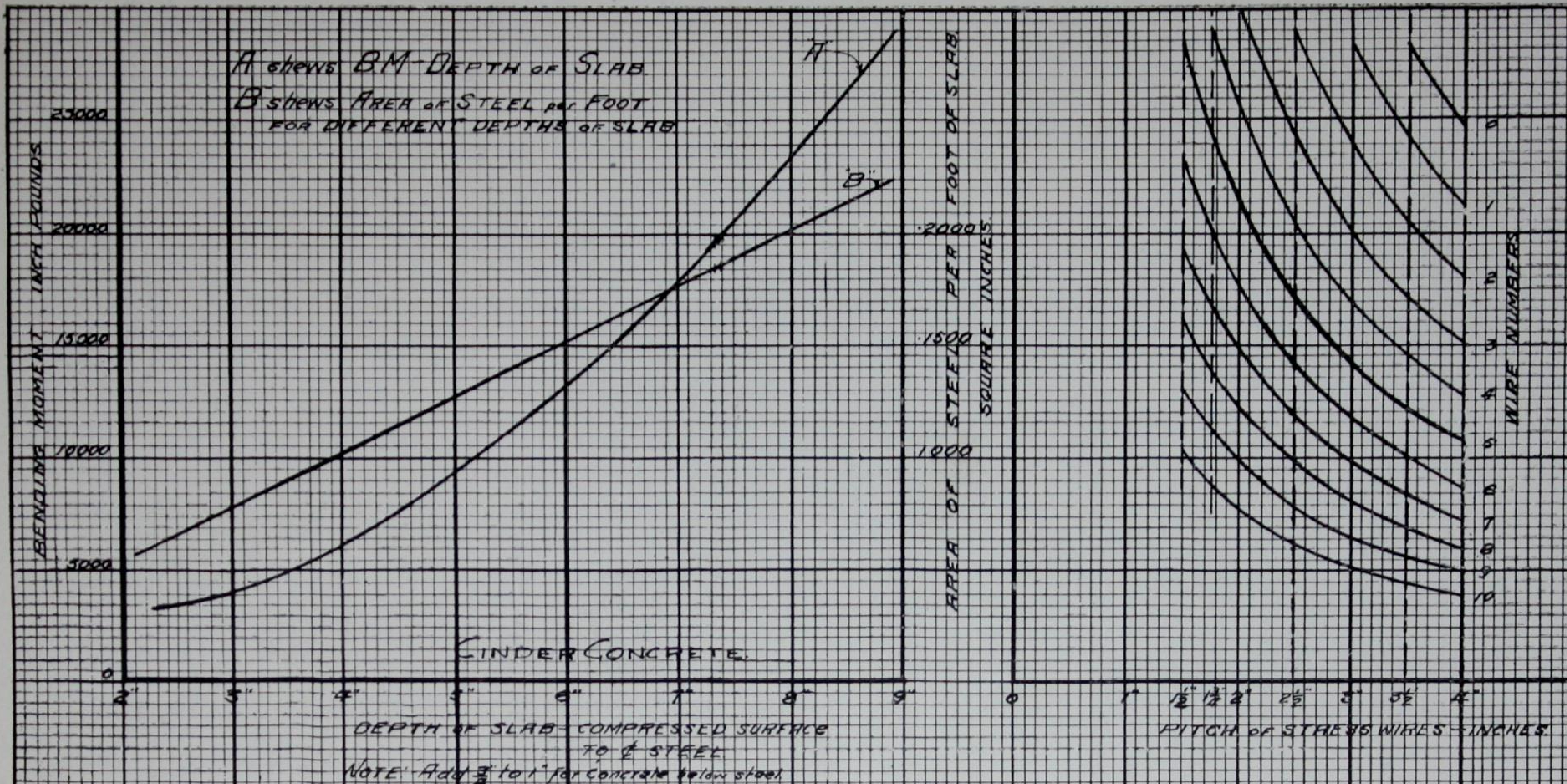
No. 0 x 4″
No. 1 x 3½″
No. 2 x 3″
No. 4 x 2″
No. 5 x 1¾″

will all satisfy the requirements and it becomes a question of adaptability and price which to use.

The same general proceedure is followed for the cinder concrete diagrams.

If the slab has already been designed and found to be thicker than necessary by the chart, the area of the steel can be reduced in inverse proportion to the two thicknesses and the weave found as in the previous manner by carrying a horizontal line from the newly found area of steel through the curves at the right.


"A" shews B.M.-Depth of Slab
B shews Area of Steel per Foot for Different Depths of Slab
BENDING MOMENT INCH POUNDS
0
5000
10000
15000
20000
25000
30000
A
B
Stone Concrete
AREA OF STEEL PER FOOT OF SLAB SQUARE INCHES
.0500
.1000
.1500
.2000
.2500
.3000
0
2"
3"
4"
5"
6"
DEPTH OF SLAB — COMPRESSED SURFACE TO ¢ STEEL
NOTE:- Add ¾" to 1" for concrete below steel.
CURVES SHEWING
AREA OF STEEL PER FOOT
DIFFERENT SIZE WIRE
DIFFERENT PITCHES
0
1"
1½"
1¾"
2"
2½"
3"
3½"
4"
PITCH OF STRESS WIRES — INCHES
WIRE NUMBERS
000
00
0
1
2
3
4
5
6
7
8
9
10


A shews B.M.-Depth of Slab.
B shews Area of Steel per Foot for different depths of Slab.
A
B
BENDING MOMENT INCH POUNDS
25000
20000
15000
10000
5000
0
2"
3"
4"
5"
6"
7"
8"
9"
CINDER CONCRETE.
DEPTH OF SLAB - COMPRESSED SURFACE TO ℄ STEEL
NOTE: Add ¾ to 1" for Concrete below steel.
AREA OF STEEL PER FOOT OF SLAB. SQUARE INCHES.
.2000
.1500
.1000
0
1"
1½"
1¾"
2"
2½"
3"
3½"
4"
PITCH OF STRESS WIRES - INCHES.
WIRE NUMBERS
0
1
2
3
4
5
6
7
8
9
10

It is important in slab work that all transverse joints in the concrete should be made at or near the centre of the span, because it is here that the shear stress is a minimum, if the load be considered as uniformly distributed.

The joints in the reinforcing material must be made at the support, by either anchoring the mesh to the support in a secure manner, or by lapping adjacent ends of two sections of the mesh.

Each end of each section should extend at least one foot over the support, thus producing a lap of two feet.

The lapping is preferable to anchoring as the mesh can be kept up near the top of the slab to take care of the "hogging" or negative bending moment.

Care must be taken not to remove the forms too soon, otherwise disaster is liable to follow.

In Summer where a slab is exposed to the heat of the sun's rays, as in the case of roof slabs, it is advisable to keep the concrete damp for a couple of days. This may be done by means of a hose or a watering can. This is important if shrinkage cracks are to be avoided.

The reason for this is that if exposed to heat, concrete will dry out before crystallization is complete, thus reducing the inherent strength of the concrete.

The preceeding calculations are all based on the fact that the mortar for surface finish, as in the case of floors, shall be poured as an integral part of the whole slab. This is made necessary by virtue of the fact that a horizontal or laminar shear exists in all slabs or beams, and a joint between the body of a slab and the finish material would not offer any resistance to this shear.

This laminar shear is well shown by the sliding over one another of the pages of a book when the pages as a whole are bent or curled, and also in the creeping action of laminated or built up springs.

It might be further stated that concrete surfacing or finish if placed after the main body of the slab has begun to set the chance will be that this surfacing will not bond to the main body, due mainly to the limey substance or "laitance"' which is always found at the top surface of all concrete work.

As slabs in actual practice are built in total thicknesses of even inches and quarter inches, and as the concrete protection to the steel may be placed at front ½" to 1" depending on the thickness of the slab, it follows that the depths of the centre of the steel to the compressed surface of the concrete will also be in even inches and quarter inches.

The Following Tables will be Useful in Obtaining Different Data relative to Slab Design, and may be Used instead of the Curve Charts

In the tables which follows (i. e.) No. IV. for stone concrete, and No. V. for cinder concrete.

B.M.—Bending moment due to span and loading as per tables I., II. and III. (See pages 11-12.)

d—Depth of slab=distance from compressed surface to center of steel, in inches.

c—Covering or protection to steel, in inches.

T—Total thickness of slab=d plus c in inches.

As—Cross sectional area of steel required per foot (transversely) of slab.

W—Weight per square foot of slab.

TABLE 4						TABLE 5					
B M	d.	c.	T	As	W	B M	d.	c.	T	As	W
7000	2½"	½	3	.1590	37.50	4990	3½"	¾	4¼	.0900	41.50
8750	2¾	½	3¼	.1750	40.50	5050	3¾	¾	4½	.0970	44.00
10250	3	½	3½	.1925	44.00	6200	4	¾	4¾	.1025	46.25
12000	3¼	¾	4	.2100	50.00	6800	4¼	¾	5	.1080	49.00
14000	3½	¾	4¼	.2250	53.50	7700	4½	¾	5¼	.1150	51.25
16100	3¾	¾	4½	.2410	56.75	8500	4¾	¾	5½	.1210	54.00
18250	4	¾	4¾	.2550	60.00	9300	5	1	6	.1275	59.00
20750	4¼	¾	5	.2720	63.00	11200	5½	1	6½	.1400	63·50
23400	4½	¾	5¼	.2875	66.00	13150	6	1	7	.1520	68.50
25800	4¾	¾	5½	.3040	69.25	15400	6½	1	7½	.1645	73.25
28400	5	1	6	.3200	75.00	17750	7	1	8	.1775	78.25
31300	5¼	1	6¼	.3350	78.00	20500	7½	1	8½	.1900	83.00
34000	5½	1	6½	.3520	82.00	23400	8	1	9	.2025	88.00
37000	5¾	1	6¾	.3700	85.50	26400	8½	1	9½	.2155	92.50
40200	6	1	7	.3880	88.00	29400	9	1	10	.2270	97.50

Having obtained the value of As, from Table No. IV. or Table No. V., the commercial weave supplied by us may be obtained from Table VI., which shows the area of steel in one foot of our mesh for different sizes of wires on different pitches.

TABLE NO. 6

AREA OF STEEL PER FOOT OF MESH

SIZE OF WIRE	PITCH OF STRESS WIRE						
	1½"	1¾"	2"	2½"	3"	3½"	4"
000	.8700	.7460	.6520	.5220	.4350	.3740	.3260
00	.7610	.6520	.5710	.5470	.3800	.3260	.2850
0	.6580	.5650	.4940	.3950	.3290	.2820	.2470
1	.5650	.4850	.4240	.3390	.2830	.2420	.2120
2	.4780	.4100	.3590	.2870	.2390	.2050	.1790
3	.3990	.3420	.2990	.2390	.2000	.1710	.1500
4	.3390	.2900	.2540	.2030	.1690	.1450	.1270
5	.2820	.2420	.2120	.1690	.1410	.1210	.1060
6	.2320	.1990	.1740	.1390	.1160	.0995	.0870
7	.1940	.1660	.1460	.1170	.0970	.0830	.0730
8	.1610	.1380	.1210	.0970	.0800	.0690	.0600
9	.1300	.1200	.0980	.0780	.0650	.0560	.0490
10	.1020	.0880	.0770	.0610	.0510	.0440	.0380

QUANTITY OF MATERIAL REQUIRED FOR 1 CUBIC YARD OF CONCRETE.

Wm. B. Fuller's Rule.

Based on 1 barrel containing 3.8 cubic feet of cement.

Divide 11 by the sum of the parts of cement, sand, and coarse aggregates. The quotient will be the number of barrels, 3.8 cu. ft. each, of cement required per cubic yard of concrete. Call this quotient N.

The number of cubic yards of sand required per cubic yard of concrete will be

$$\frac{\text{N x 3.8 x No. of parts of sand}}{27}$$

The number of cubic yards of stone will be

$$\frac{\text{N x 3.8 x No. of parts of stone}}{27}$$

Thus for a concrete c: s: g.

Where c—cement.
s—sand.
g—coarse aggregate.

No. of barrels cement per cu. yard concrete.................. $\frac{11}{c+s+g}$ -N

No. of cu. yards sand per cu. yard concrete .... $\frac{N \times 3.8 \times s}{27}$

No. of cu. yards coarse aggregate per cu. yard concrete .... $\frac{N \times 3.8 \times g}{27}$

QUANTITY OF MATERIAL REQUIRED FOR ONE CUBIC YARD OF CONCRETE, BASED ON 1 BARREL OF CEMENT CONTAINING 3.8 CUBIC FEET.

Proportions.	Bbls. Cement.	Cu. Yds. Sand. Loose.	Cu. Yds. Stone. Loose.
1: 1 : 2.	2.75	.388	.775
1: 1½: 3.	2.00	.422	.845
1: 2 : 4.	1.57	.442	.885
1: 2½: 5.	1.295	.455	.910
1: 3 : 6.	1.100	.465	.930

WEIGHTS OF DIFFERENT MATERIALS.

Material.	Quantity.	Weight Pounds.
Portland Cement	1 cubic foot (packed)	100
Sand (dry)	1 cubic foot (loose)	98–115
Sand (damp)	1 cubic foot (loose)	90–100
Gravel (with sand)	1 cubic foot (loose)	130
Rocks—		
Conglomerage	45% voids 1 cubic foot (loose)	79.0
Granite	45% voids 1 cubic foot (loose)	92.5
Limestone	45% voids 1 cubic foot (loose)	79.0
Trap	45% voids 1 cubic foot (loose)	99.0
Sandstone	45% voids 1 cubic foot (loose)	82.5
Cinders, bituminous	45% voids 1 cubic foot (loose)	52.3

Weight per cubic yard is found by multiplying the above weights by 27.

1 Board Foot of	Weighs Pounds.
White Ash	3.2
Cork	1.3
Hemlock	2.1
Maple	4.1
Live Oak	4.8
White Oak	4.0
Red Oak	3.2
White Pine	2.1
Yellow Pine	2.8
Southern Pine	3.7
Spruce	2.1

WEIGHTS OF ROOFING MATERIAL.

Material.	Average Weight. Pounds per Square Foot.
Corrugated galvanized iron, no boards	2¼
Felt and Asphalt, no boards	2
Neponset Roofing Felt (2 ply)	½
Slate, 3″ lap	4½–6¾
Shingles, 1/3 to weather	2
Slag Roof, 4-ply	4
Tiles	8½–18

BEARING POWER OF GROUND

Hard Rock, natural bed	100	tons sq. ft.
Hard Rock, equal to 1st class masonry	25–40	" "
Hard Rock, equal to 1st class brick	15–20	" "
Dry Clay, thick beds	4– 6	" "
Damp Clay, thick beds	2– 4	" "
Soft Clay, thick beds	1– 2	" "
Gravel, well cemented	8–10	" "
Sand, well cemented and compact	4– 6	" "
Sand, dry	2– 4	" "
Quick Sands and Loomy Soils	5/10– 1	" "

PRESSURE OF WIND.

Velocity	Pressure Normal. Lbs.	
10	0.4	Fresh breeze.
20	1.6	Stiff breeze.
30	3.6	Strong wind.
40	6.4	High wind.
50	10.0	Storm.
60	14.4	Violent storm.
80	25.6	Hurricane.
100	40.0	Violent Hurricane.

NORMAL ROOF PRESSURE BASED ON VIOLENT HURRICANE.

Rise per Foot Run.	Angle to Horizontal.	Pitch Ratio.	Normal Wind Pressure Pounds per Sq. Ft.
4	18° 25′	1/6	16.8
6	26° 33′	¼	23.7
8	33° 41′	1/3	29.1
12	45° 00′	½	36.1
16	53° 7′	2/3	38.7
18	56° 20′	¾	39.3
24	63° 27′	1	40.0

Fresh snow weighs from 5 to 12 pounds per cubic foot.

Wet snow weighs from 15 to 90 pounds per cubic foot.

We ship in the Roll or in Sheets cut to size.

Our Reinforcement can be made in any width not exceeding 8 feet.

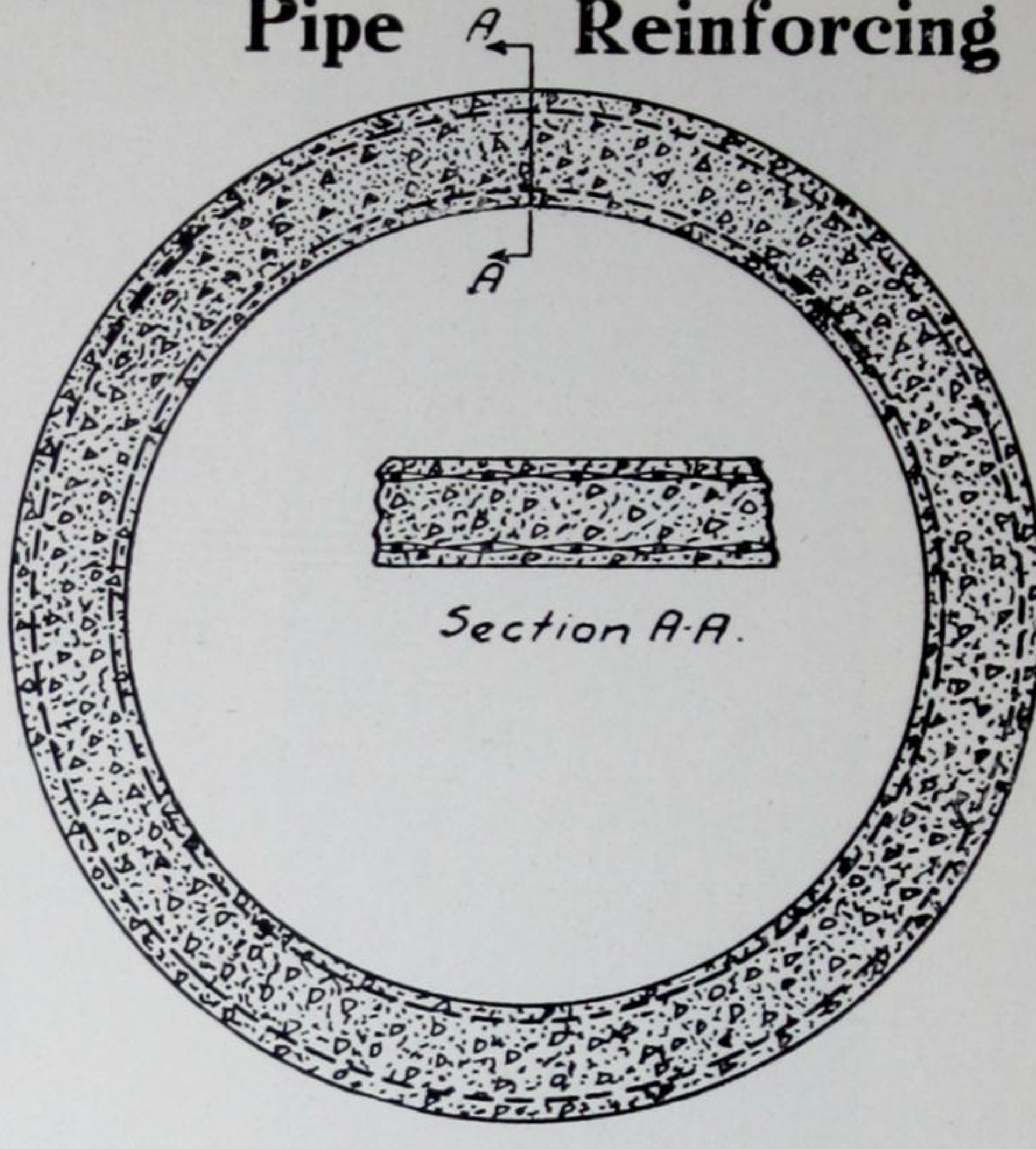
Cold Drawn Crimped Steel Wire Bonding

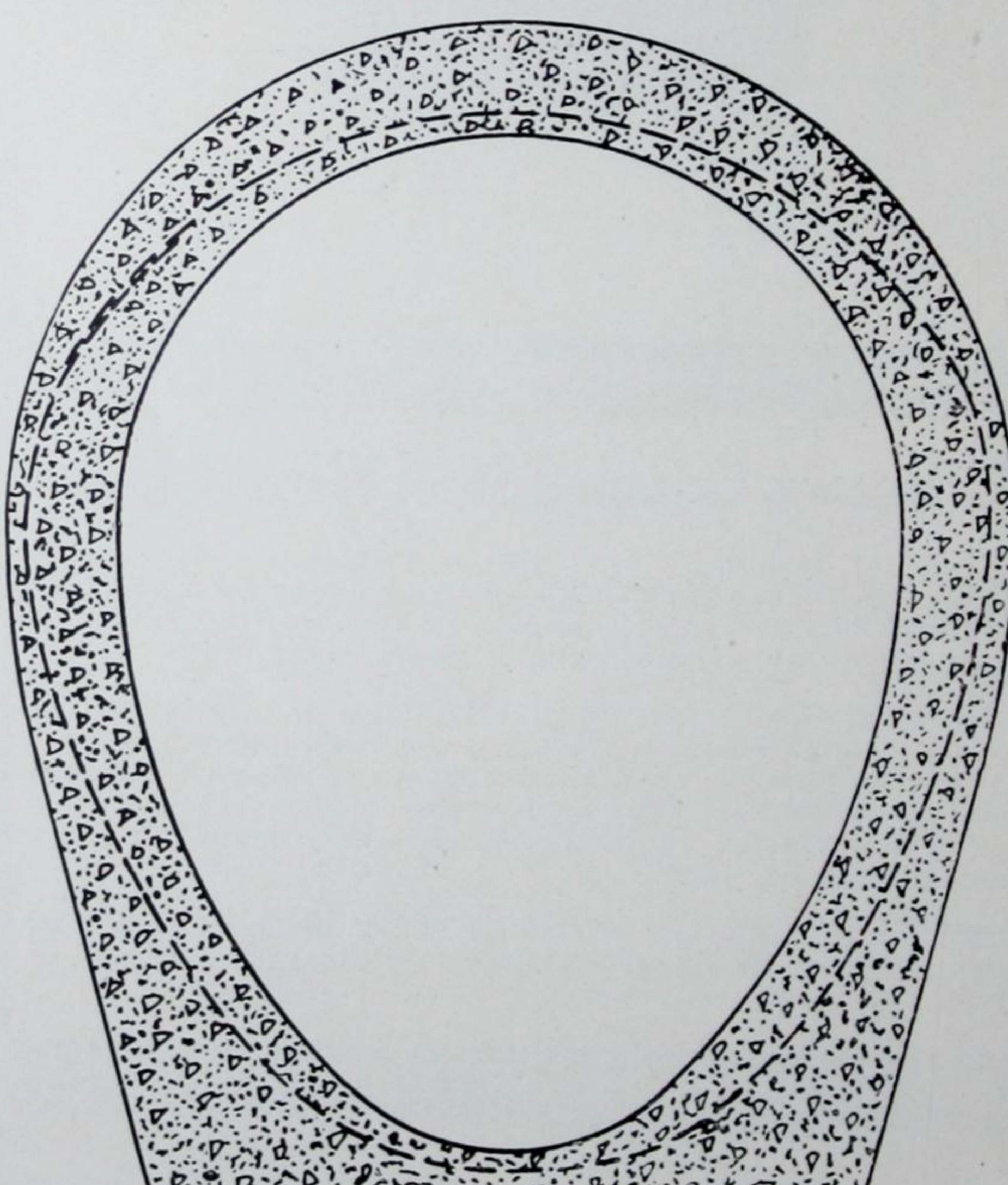
The many advantages of continuous reinforcements over the sectional systems are appreciated by all who have given this subject careful consideration; especially is this true in entire concrete structures or concrete beam or girder construction.

It is a fact admitted by our competitors that a series of concrete beams reinforced continuously over fixed supports will develop greater strength than similar series of beams reinforced by sectional materials. This is also true of flat arch floor construction whether the supporting beams and girders are of reinforced concrete or steel.

Continuous reinforcement can be laid at much less cost and entirely eliminate the danger so often resulting in the collapse of sectional materials.

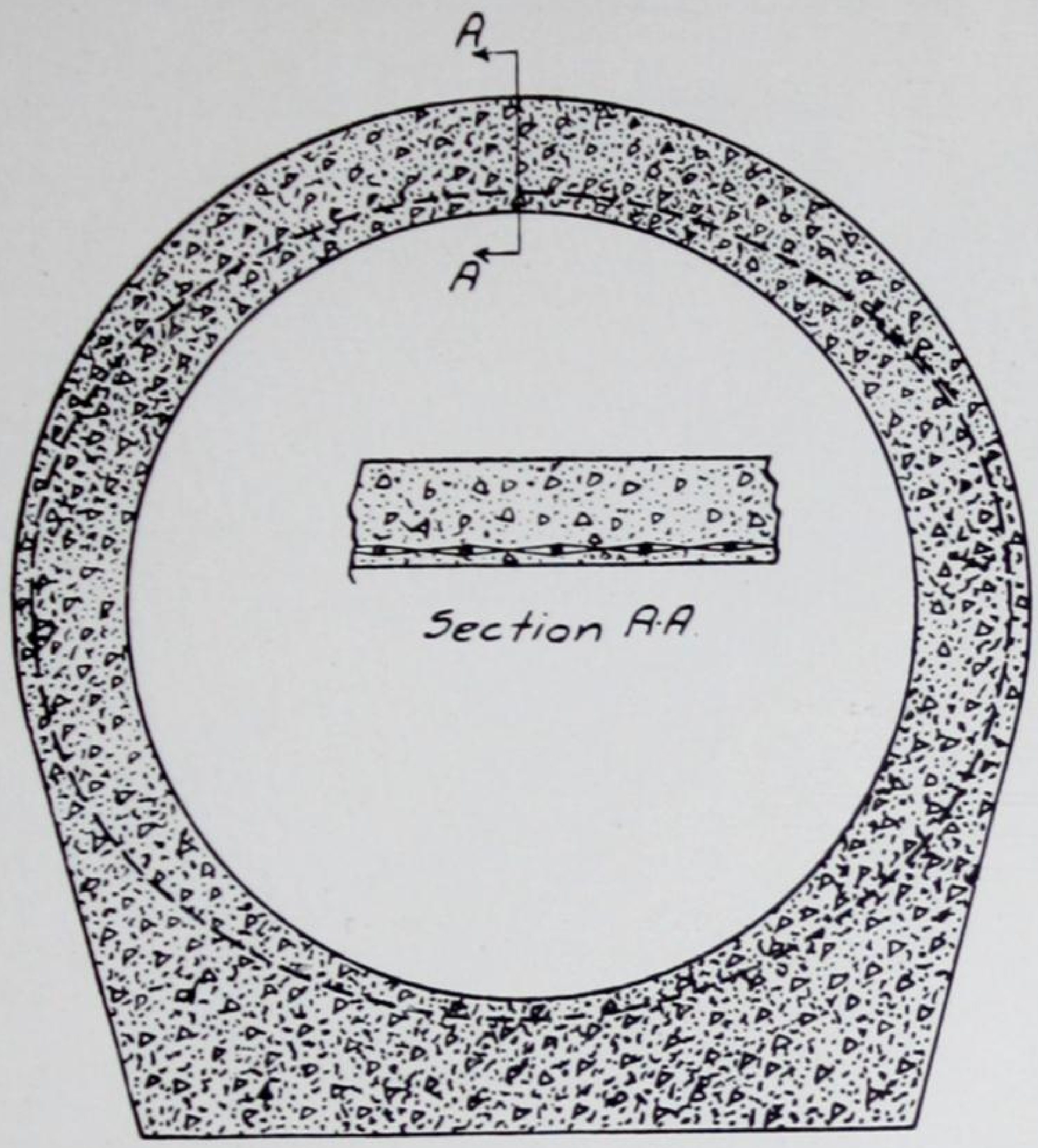
Pipe Reinforcing



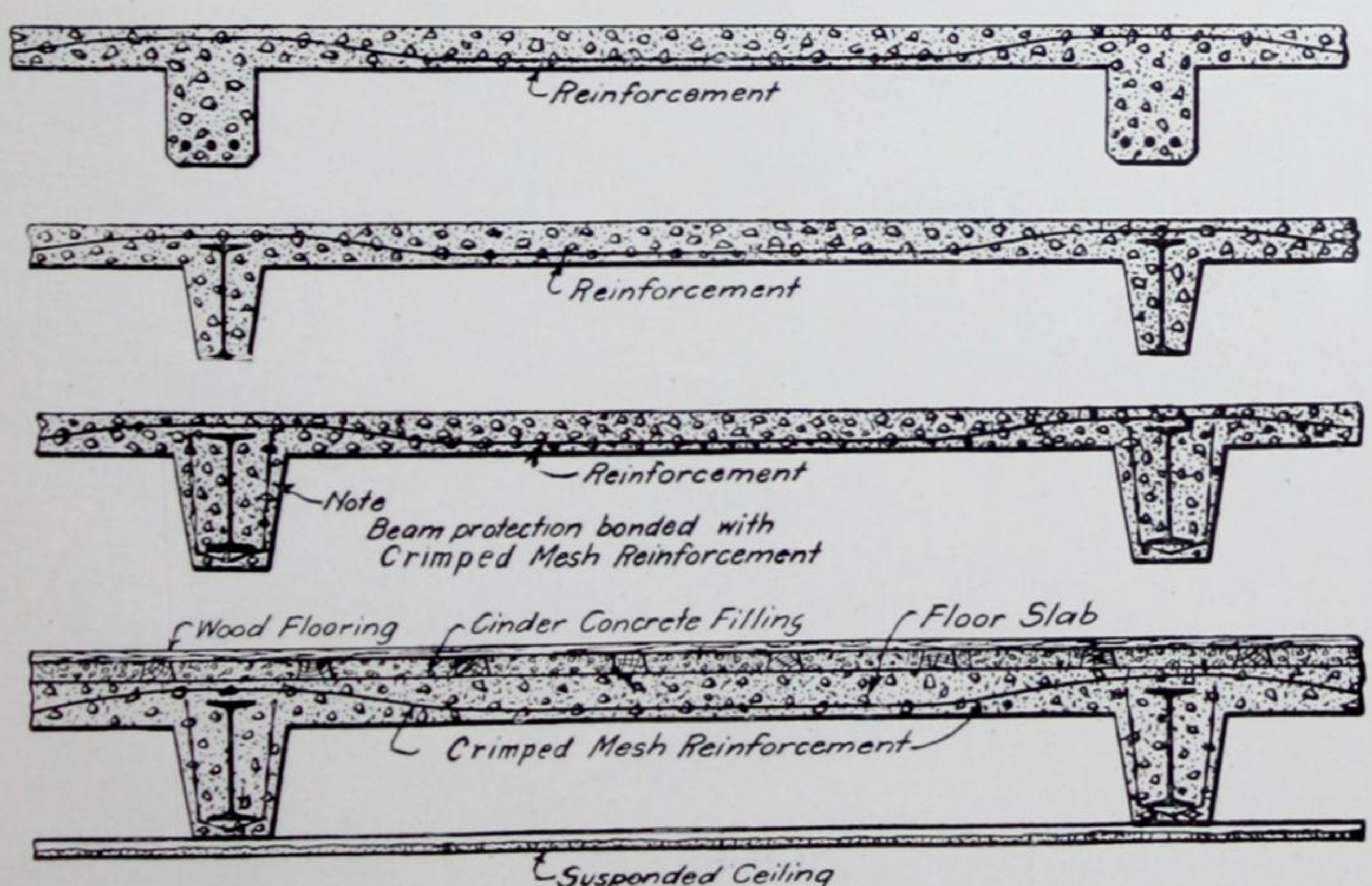


The use of reinforced concrete construction in water pipes, sewers, conduits, culverts and similar underground work is one of the oldest applications of same. Our fabric can be supplied in continuous lengths sufficient to entirely cover the circumference of the work being done.

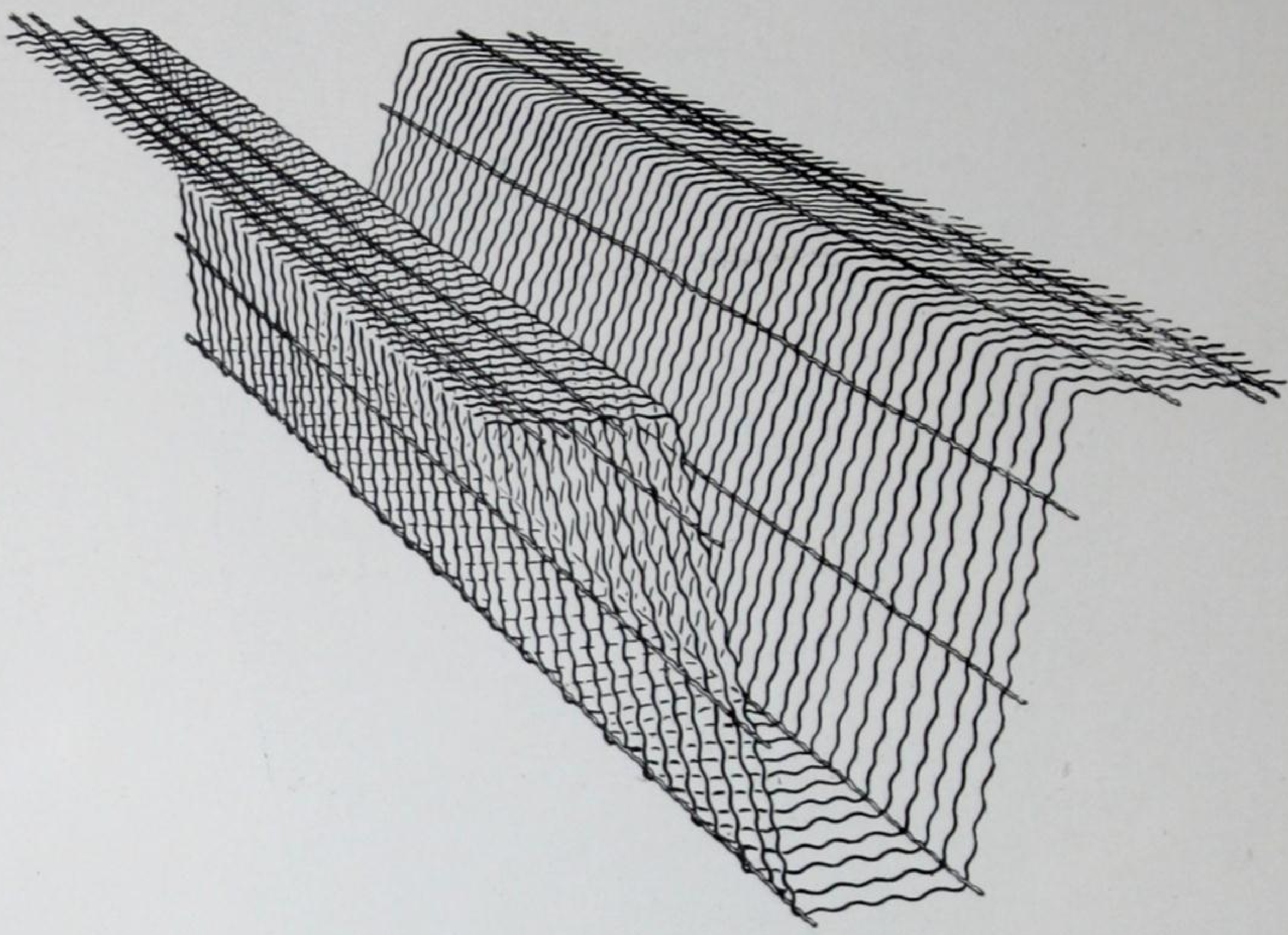
Pipe Reinforcing



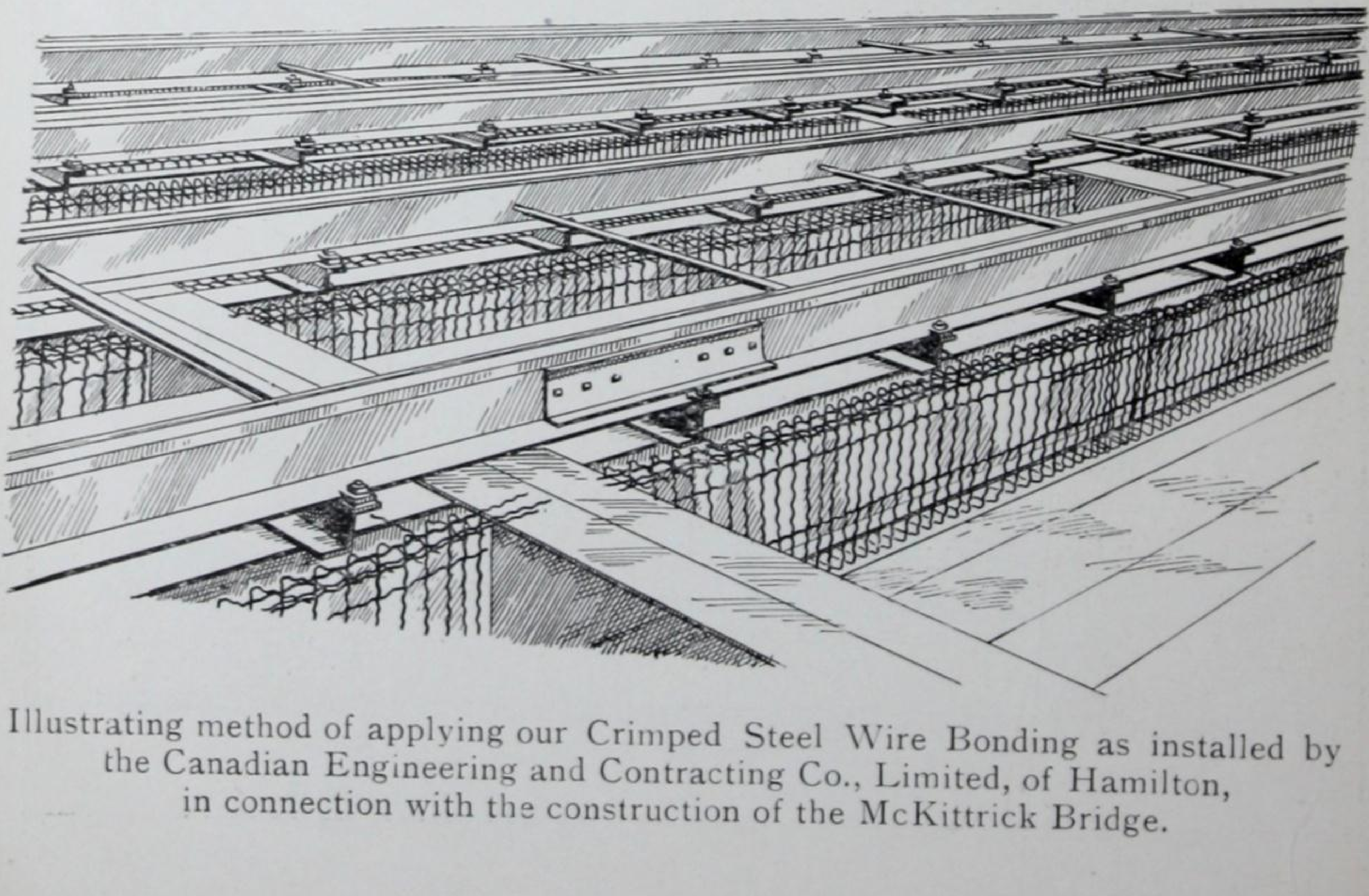
Slab Construction



Fireproofing



Illustrating the utility of our Crimped Steel Wire Bonding for Fireproofing as applied to Beam and Column Work.



Illustrating method of applying our Crimped Steel Wire Bonding as installed by the Canadian Engineering and Contracting Co., Limited, of Hamilton, in connection with the construction of the McKittrick Bridge.

Various Wire Gauges in Use in Canada and United States

No.	British Imperial Standard Gauge	Birmingham Gauge (Stubbs)	American or Brown & Sharpe's Gauge	Washburn & Moen Mfg. Co's Gauge	Trenton Iron Co's Gauge	Old English Gauge
0000	.400	.454	.46	.394	.400	.454
000	.372	.425	.40964	.363	.360	.425
00	.348	.380	.3648	.331	.330	.380
0	.324	.340	.32486	.307	.305	.340
1	.300	.300	.2893	.283	.285	.300
2	.276	.284	.25763	.263	.265	.284
3	.252	.259	.22942	.244	.245	.259
4	.232	.238	.20431	.225	.225	.238
5	.212	.220	.18194	.207	.205	.220
6	.192	.203	.16202	.192	.190	.203
7	.176	.180	.14428	.177	.175	.180
8	.160	.165	.12849	.162	.160	.165
9	.144	.148	.11443	.148	.145	.148
10	.128	.134	.10189	.135	.130	.134
11	.116	120	.090742	.120	.1175	.120
12	.104	.109	.080808	.106	.105	.109
13	.092	.095	.071961	.092	.0925	.095
14	.080	.083	.064084	.080	.080	.083
15	.072	.072	.057068	.072	.070	.072
16	.064	.065	.05082	.063	.061	.065
17	056	.058	.045257	.054	.0525	.058
18	.048	.049	.040303	.048	.045	.049
19	.040	.042	.03589	.041	.040	.040
20	.036	.035	.031961	.035	.035	.035
21	.032	.032	.028462	.032	.031	.0315
22	028	.028	.025347	.0286	.028	.0295
23	.024	.025	.022571	.0258	.025	.027
24	.022	.022	.0201	.0225	.0225	.025
25	.020	.020	.0179	.020	.020	.023
26	018	.018	.01594	.018	.018	.0206
27	.0164	.016	.014195	.017	.017	.01875
28	.0149	.014	.012641	.016	.016	.0165
29	.0136	.013	.011257	.015	.015	.0155
30	.0124	.012	.010025	.014	.014	.01375
31	.0116	.010	.008928	.0132	.013	.01225
32	.0108	.009	.00795	.0128	.012	.01125
33	.0100	.008	.00708	.0118	.011	.01025
34	.0092	.007	.006304	.0104	.010	.0095
35	.0084	.005	.005614	.0095	.0095	.009
36	.0076	.004	.005	.009	.009	.0075
37	.0068			.0085	.0085	.0065
38	.0060			.008	.008	.00575
39	.0052			.0075	.0075	.005
40	.0048			.007	.007	.0045

TABLE OF SIZES

Iron and Steel Wire. British Imperial Standard Gauge

Sectional Area in Sq. Inches	No.	Full Size of the Wire	Decimals of Inch	Breaking Strain LBS.
.1087	000		.372	8694
.0951	00		.348	7608
.0824	0		.324	6595
.0707	1		.300	5655
.0598	2		.276	4785
.0499	3		.252	3990
.0423	4		.232	3381
.0353	5		.212	2824
.0290	6		.192	2476
.0243	7		.176	2136
.0201	8		.160	1813
.0163	9		.144	1507

No.	Full Size of the Wire	Decimals of Inch	Breaking Strain LBS.	Sectional Area in Sq. Inches
10		.128	1233	.0129
11		.116	1010	.0106
12		.104	810	.0085
13		.092	631	.0066
14		.080	474	.0050
15		.072	372	.0041
16		.064	292	.0032
17		.056	222	.0025
18		.048	169	.0018
19		040	137	.0013
20		.036	107	.0010
21		.032		.00075
22		.028		.00061
23		.024		.00049
24		.022		.000397
25		.020		.000314
26		.018		.000254
27		.0164		.000227
28		.0148		.000201
29		.0136		.000176
30		.0124		.000153

We give below a table showing the tensile strength of stress wires only in one foot of the width of fabric spaced on the given centres.

Size on Wire Gauge	Diameter in Inches	Weight per foot of One Wire	Tensile Strength of One Wire	Tensile strength of longitudinal wires only in one foot of the width of wire bonding when spaced as follows: 2 inch centres	$2\frac{1}{2}$ inch centres	3 inch centres	$3\frac{1}{2}$ inch centres	4 inch centres
0	.324	.271	6595	39570	31656	26380	22621	19785
1	.300	.232	5655	33930	27144	22620	19397	16965
2	.276	.196	4785	28710	22968	19140	16413	14355
3	.252	.164	3990	23940	19152	15960	13685	11970
4	.232	.139	3381	20286	16228	13524	11597	10143
5	.212	.116	2824	16944	13555	11209	9686	8472
6	.192	.095	2476	14856	11885	9904	8493	7428
7	.176	.080	2136	12816	10253	8544	7326	6408
8	.160	.066	1813	10878	8702	7252	6219	5439
9	.144	.054	1507	9042	7234	6028	5169	4521
10	.128	.045	1233	7398	5918	4932	4229	3699
11	.116	.035	1010	6060	4848	4040	3464	3030
12	.104	.028	810	4860	3888	3240	2778	2430

Transverse wires may be spaced on the following centres, $2\frac{1}{2}$, 4, $5\frac{1}{2}$, 7, $8\frac{1}{2}$ in.

NOTES

ECHLIN PRESS 211 KING ST. EAST